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Mobile phones, in combination with a computer locator system, improve the response times of emergency medical services in central London

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ABSTRACT

INTRODUCTION The aim of this study was to determine whether mobile phones and mobile phone locating devices are associated with improved ambulance response times in central London.

PATIENTS AND METHODS All calls from the London Ambulance Service database since 1999 were analysed. In addition, 100 consecutive patients completed a questionnaire on mobile phone use whilst attending the St Thomas's Hospital Emergency Department in central London.

RESULTS Mobile phone use for emergencies in central London has increased from 4007 (5% of total) calls in January 1999 to 21,585 (29%) in August 2004. Ambulance response times for mobile phone calls were reduced after the introduction of the mobile phone locating system (mean 469 s versus 444 s; *P* = 0.0195). The proportion of mobile phone calls made from mobile phones for life-threatening emergencies was higher after injury than for medical emergencies (41% versus 16%, *P* = 0.0063). Of patients transported to the accident and emergency department by ambulance, 44% contacted the ambulance service by mobile phone. Three-quarters of calls made from outside the home or work-place were by mobile phone and 72% of patients indicated that it would have taken longer to contact the emergency services if they had not used a mobile.

CONCLUSIONS Since the introduction of the mobile phone locating system, there has been an improvement in ambulance response times. Mobile locating systems in urban areas across the UK may lead to faster response times and, potentially, improved patient outcomes.

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Over recent years, there has been a substantial increase in the number of people who own mobile phones world-wide.[1] Several reports have now appeared in the press and popular media in which mobile phone calls have led to successful rescues of injured or sick individuals, often in remote locations. Since 1998, the emergency services have been able to locate 999 calls made from landlines automatically. In February 2004, the London Ambulance Service NHS Trust introduced the Enhanced Information Service for Emergency Calls (EISEC) locator system for mobile phone calls in the central London area. This system identifies the location of a mobile phone call on any of the major networks (Vodafone, O_2, 3, T-mobile, Orange, British Telecom and Cable & Wireless).

The first call is used for each incident, a set of co-ordinates are passed on to the ambulance control centre which are superimposed on a computerised map allowing control room staff to ask further questions in order to pinpoint the exact location of the incident. The response time is from when the initial call is lodged to the arrival of the ambulance. In urban areas with a high density of phone masts, the EISEC system can locate a mobile phone position within a small radius, sometimes as little as 30 m, although this can increase to over 3000 m in rural areas with fewer masts. The EISEC system can also assist in detecting hoax calls by identifying when the location of the caller is not in the vicinity of the incident.

A number of studies have examined the perceived risks of excessive use of mobile phones;[2–4] however, to our knowledge, only one study has been published on the potential benefits in improving access to emergency medical care.
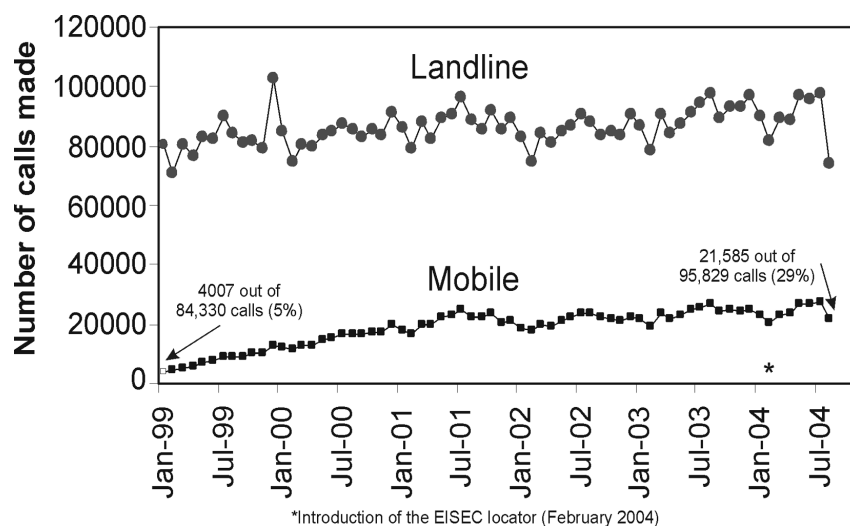
Figure 1 A comparison between numbers of calls made from a landline compared to a mobile phone over the last 5 years.

This telephone-based questionnaire, carried out in Australia, found that 1 in 8 of those surveyed had used a mobile phone to report a road traffic accident and 1 in 45 had used a mobile to report being lost in rural areas.[5]

The benefits of rapid resuscitation and transfer of severely injured patients to hospitals has been clearly established.[6–9] We sought to investigate whether there was any evidence that the increased availability of mobile phones was having a beneficial effect in reducing the response times to accidents and other medical emergencies in a major city.

Patients and Methods

PubMed and Medline searches were carried out using the keywords: response times, mobile phones, trauma and computer locating devices. All calls made to the London Ambulance Service (LAS) from January 1999 to August 2004 were reviewed. Mobile phone calls were identified using the 07 prefix, which was introduced for all mobile phone numbers in 1999.

For the last 2 months of the study, an Enhanced Information Service for Emergency Calls (EISEC) locator system was used to identify a caller's location for most major mobile phone networks. Ambulance response times for mobile phone calls made for life-threatening emergencies when the locating system was available were then compared with those when no system was available. The nature and seriousness of the emergency was categorised according to the Advanced Medical Priority Dispatch System (AMPDS) codes used by LAS. Subgroup analysis was
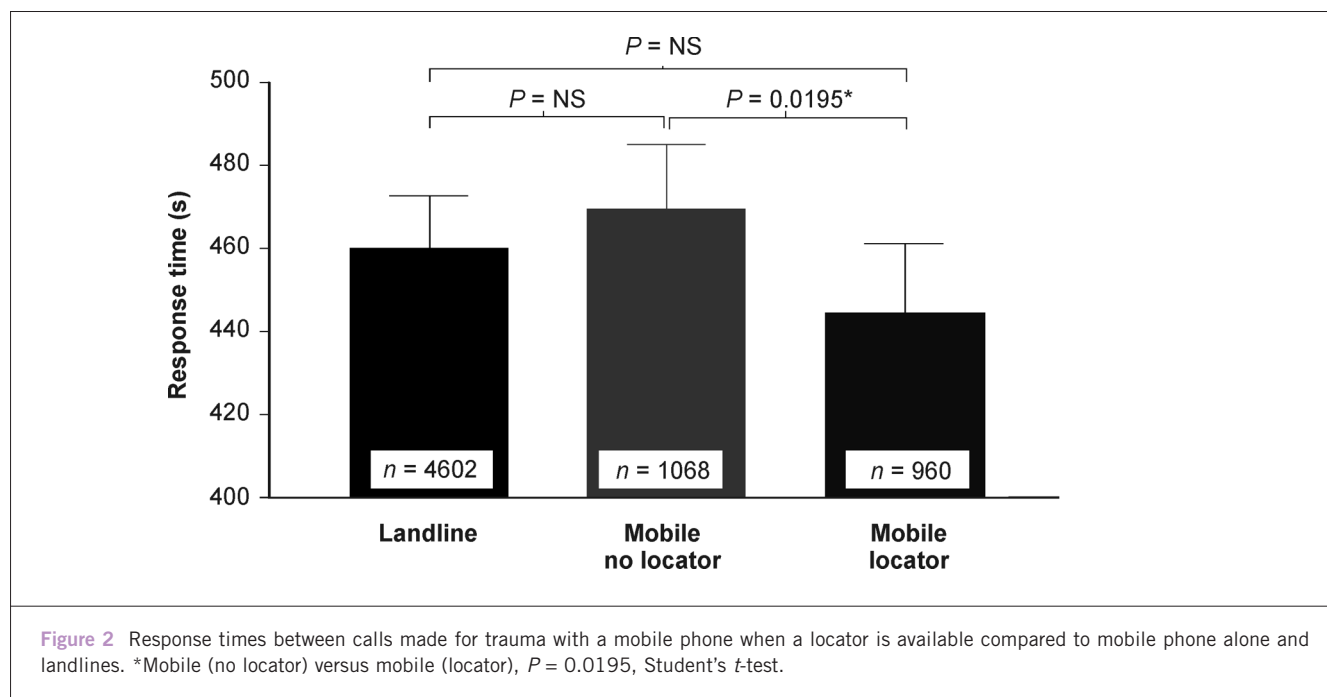
then possible to compare calls related to trauma and road traffic accidents. The response times in each group were calculated as means with 95% confidence intervals and compared with the Student's *t*-test.

In addition, 100 out of 106 patients (94%) approached whilst attending the Accident and Emergency Department at St Thomas's Hospital filled out a questionnaire. The questionnaire inquired into the patient's use and perception of mobile phones and landlines in summoning emergency help.

Results

The use of mobile phones in emergencies has increased steadily from 4007 calls per month (5% of the total) in January 1999 to 21,585 (29%) in August 2004 (Fig. 1). A UK Government directive in 2000[10] introduced a target of 8 min for response times for life-threatening emergencies. Since then, the number of calls with a response time of less than 8 min has increased from 38% to 72% in August 2004. The number of calls made for life-threatening emergencies (45,412 calls in January 2000 and 45,551 calls in August 2004) and the proportion of patients taken to hospital after the emergency call (53,606 calls in January 2000 and 54,789 calls in August 2004) has not changed significantly over this period.

Since the introduction of the mobile phone locating system, there has been no significant difference in the overall response times to life-threatening calls made on mobile phones when compared with landlines (mean 446 s [95% CI 397–495; *n* = 11,009] versus 452 s [95% CI 410–494; *n* = 42,450;

Figure 2 Response times between calls made for trauma with a mobile phone when a locator is available compared to mobile phone alone and landlines. *Mobile (no locator) versus mobile (locator), P = 0.0195, Student's t-test.

P = 0.8]). The analysis of mobile phone calls alone, however, did reveal a significant improvement in response times to emergency calls using the EISEC locator system (mean 432 s with EISEC [95% CI 414–451; n = 6432] versus 463 s without EISEC [95% CI 443–484; n = 4577; P = 0.032]). The use of the EISEC system to locate mobile phones for incidents coded by AMPDS as trauma or road traffic accidents was also associated with a faster response time (mean 469 s [95% CI 425–513; n = 1068] versus 444 s [95% CI 398–490; n = 960; P = 0.0195; Fig. 2]). The proportion of calls made from mobile phones is higher in trauma than in medical emergencies (41% versus 16%; n = 22,825; P = 0.006), probably reflecting the ready availability of mobile phones compared with landlines at the scene of these incidents.

Out of 100 patients attending the Accident and Emergency Department at St Thomas's Hospital, 44 had used a mobile phone to contact the ambulance service. Calls outside the home or workplace were mainly by mobile phone (18 of 26; 70%). The majority of calls made at home or in the work-place were from landlines (48 of 74; 65%), with 13% (6 of 48) using the landline due to poor mobile phone reception.

Outside the home or work-place, 24% of mobile phone users had problems with phone reception (11 of 44), and only 17% (3 of 18) had access to a landline at the scene. A further 24% (11 of 44) had problems describing their location, which was not applicable to landline users. The majority of these callers (13 of 18; 72%) felt that if they had not used a mobile phone, it would have taken longer to contact the ambulance services. All landline users outside the home

or work, felt it took less than 10 min to find a landline; of those 25% (2 of 8) thought a mobile may have still saved time.

Discussion

This study is the first to demonstrate that the use of mobile phones combined with the EISEC mobile phone locating system reduces the response time of medical emergencies within a densely populated urban environment. The increased proportion of mobile phone calls made over the 5-year period reflects their wide-spread availability, despite the absolute number of calls remaining relatively unchanged. The increased availability of mobile phones has not led to a rise in the number of inappropriate calls, as there were a similar number of total calls in 2000 and 2004 resulting in patient transfer to hospital and for life-threatening events.

There are two stages in the process of getting help from the emergency services when an incident occurs. The first stage is the time taken from the incident occurring to making an emergency 999 call. The data from the patient survey suggested that, in incidents occurring outside the home or work-place, access to a mobile phone reduces the time taken from the incident occurring to calling the emergency services. Phone reception still seemed to be an important factor even though this study was carried out in an inner city area.

The second stage of the emergency response is the time taken by the emergency services to respond to the 999 call. From the London Ambulance Service data, we found that

the use of a mobile phone was not associated with a faster response time when compared with the use of a landline. The use of a mobile phone locator does, however, result in faster response time after a call from a mobile phone. This may reflect the difficulty the ambulance call receiver may have in identifying the location of a mobile phone user without a locating device. This improvement is mainly seen for calls classified as trauma or road traffic accident by the ambulance triage system. The majority of these types of calls are made outside the home or work when the use of a locating device would be most useful.

A UK Government directive issued in 2000 aimed to reduce the response times for life-threatening emergencies to under 8 min. This resulted in a number of organisational changes including a priority dispatch system combined with an increase in the numbers of fast response cars and motor-cycles. The improvement in response times between 2000 and the introduction of the EISEC system in early 2004 is probably as a consequence of these changes. Our study has, however, shown that the introduction of the EISEC system in 2004 was associated with a modest, but significant, improvement in response times since these changes. This is because the time taken to pinpoint the location of an incident and to direct the dispatch of an emergency response vehicle has improved, especially for life-threatening emergencies.

The study was based on the figures obtained from an inner city area where landlines are readily available. In a rural area, landlines may not be available and the patient's location may be more difficult to describe. The widespread investigation of mobile phone locating systems across the UK may lead to faster response times in both urban and rural areas and has the potential to improve patient outcomes.

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